

REMARKS

This Amendment is submitted in reply to the Office Action dated August 26, 2003. Applicant respectfully requests reconsideration and further examination of the patent application under 37 C.F.R. § 1.111.

Upon entry of the foregoing Amendment, Claims 4, 6, 9-12, 20, 24, 26-30, 32, 38-41, 43-46, 48-49, 57-58, 60-67 and 69-96 are pending in the application. The amendments are believed to introduce no new matter, and their entry is respectfully requested. Based on the above amendment and the following remarks, Applicant respectfully requests that the Examiner reconsider and withdraw all outstanding objections and rejections.

Summary of the Examiner's Objections and Rejections

The specification was objected to for lacking a sentence at page 1, line 1, referring to the provisional application from which the instant application claimed benefit

Claims 6, 10-12, 20, 22, 24, 26-30, 32, 38-41, 43-46, 48-49, 57-58 and 60-64 were objected to for various reasons.

Claims 22 and 62 were rejected under 35 U.S.C. 112 (second paragraph) as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Claims 4, 6, 12, 24, 28, 30, 32, 39, 45-46, 57-58 and 62-64 were rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as being obvious over Skotheim (US 4,442,185).

Claims 6, 9-12, 24, 27-29, 38-41, 43-46, 48-49, 57 and 61-63 were rejected under 35 U.S.C. 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as being obvious over Han (US 6,150,605).

Claims 4, 6, 9, 12, 24, 27-30, 32, 39, 45-46, 48, 57-58 and 61-64 were rejected under 35 U.S.C. 103(a) as being obvious over Skotheim (US 4,442,185) in view of Green (US 5,080,725).

Claims 6, 9-12, 24, 27-30, 38-41, 43-46, 48-49, 57 and 61-64 were rejected under 35 U.S.C. 103(a) as being obvious over Han (US 6,150,605) in view of Lindmayer (US 3,949,463).

Claim 22 would be allowable if amended to overcome the rejection under 35 U.S.C. 112 (second paragraph) and the objection for various informalities.

Claims 20, 26 and 60 would be allowable if amended to overcome the objection for various informalities.

Claims 65-67 and 69-96 were allowed.

Summary of Amendment

Applicant has amended Claims 4, 6, 9-12, 20, 24, 26-30, 32, 38-41, 43-46, 48-49, 57-58 and 60-64 to more particularly define the present invention.

Remarks Regarding Objection to Specification

Applicant has amended the specification so that the present application refers to the provisional patent application from which the present application claims benefit. As such, Applicant respectfully requests that the Examiner withdraw the objection to the specification.

Remarks Regarding Objections to Claims

Applicant has amended Claims 6, 10-12, 20, 22, 24, 26-30, 32, 38-41, 43-46, 48-49, 57-58 and 60-64 to correct various informalities. Applicant thanks the Examiner for pointing out such informalities and in view of the amendments Applicant respectfully requests that the Examiner withdraw the objections to these claims.

Remarks Regarding §112 (second paragraph) Rejections to Claims 20 and 62

Applicant has amended Claim 22 to remove the term "predetermined" and amended Claim 62 to correct the antecedent error. As such, Applicant respectfully requests that the Examiner withdraw the 112 rejections to these claims.

Remarks Regarding §102(b), §102(e) and §103(a) Rejections

Applicant respectfully submits that independent Claim 4 as amended is patentable over Skotheim, Han, Green and/or Lindmayer. The claimed invention as recited in amended independent Claim 4 is directed to a multilayer solid-state device for producing electrical power from light comprising: a light energy conversion layer containing photosensitive means; a two-sided conducting layer having the light energy conversion layer secured to a first side thereof; a charge separation layer secured to a second side of the conducting layer, wherein the conducting layer and the charge separation layer define a Schottky barrier, and the conducting layer comprises an ultra-thin metal film for providing ballistic transport of charge carriers from the light energy conversion layer to the charge separation layer which eliminates the need for an electrolyte when producing electrical power from light that impinges upon the light energy conversion layer (emphasis added to show distinguishing limitations). Amended independent Claims 6, 9-12, 20, 24, 26-30, 32, 38-41, 43-46, 48-49, 57-58 and 60-64 contain the same or similar distinguishing limitations which are recited in pending Claim 4.

Skotheim discloses a photoelectrochemical cell that converts solar energy to electricity. In one embodiment shown in FIGURE 13, the photoelectrochemical cell includes in sequence a n-type semiconductor 131 attached to a highly conductive layer 134 which is attached to a dry solid polymer electrolyte 133 which is attached to a p-type semiconductor 132. The highly conductive layer 134 is a polymer blend of a highly conductive polymer such as polypyrrole and a solid polymer electrolyte (see, e.g., col. 15, lines 33-41). In another embodiment shown in FIGURE 4, the photoelectrochemical cell which is an electrolytic Schottky barrier includes in sequence a transparent cover 25, a electrode 21 (thin metal film), a polymer electrolyte 23, a semiconductor 22 and another electrode 26.

Han discloses a photovoltaic cell and manufacturing method thereof. As shown in FIGURE 1, the photovoltaic cell has a laminated structure including in sequence a first electrode layer 2, a first photovoltaic layer 3, an electrically conductive layer 5, a second photovoltaic layer 7 and a second electrode layer 8. The first photovoltaic layer 3 is a semiconductor film containing a first colorant 4. And, the second photovoltaic layer 7 is a semiconductor film containing a second colorant 6. The first colorant 4 and the second colorant 6 are different from each other so that the first photovoltaic layer 3 and the second photovoltaic layer 7 have different photocurrent action spectra. The electrically conductive layer 5 sandwiched between the semiconductor layers 3 and 7 is composed of an electrically conductive material that can transport electrons, holes or ions. The disclosed electrically conductive materials include a hole-transporting material such as polyvinylcarbazole, an electron transporting material such as tetranitrofluorenone, an electrically conductive polymer such as polypyrrole and an ion conductor such as a liquid electrolyte or a solid polymer electrolyte (see, e.g., abstract, col. 5, lines 12-22).

The teachings of Skotheim and Han differ in several respects from the pending independent Claims 4, 6, 9-12, 20, 24, 26-30, 32, 38-41, 43-46, 48-49, 57-58 and 60-64. First, the claimed multilayer solid-state device includes a limitation where an ultra-thin metal film provides ballistic transport of charge carriers from the light energy conversion layer to the charge separation layer which eliminates the need for an electrolyte when producing electrical power from light that impinges upon the light energy conversion layer. Skotheim and/or Han teach away from the claimed multilayer solid-state device that uses an ultra-thin metal film to eliminate the need for an electrolyte when producing electrical power from light that impinges upon a light energy conversion layer. Instead, Skotheim discloses several devices all of which require the use of an electrolyte to produce electrical power. In one embodiment, Skotheim teaches away from the claimed multilayer solid-state device because it discloses a photoelectrochemical cell that includes in sequence a n-type semiconductor 131 attached to a highly conductive layer 134 which is attached to a dry solid polymer electrolyte 133 which is attached to a p-type semiconductor 132 (see FIGURE 13). In another embodiment, Skotheim teaches away from the claimed multilayer solid-state device because it discloses a

photoelectrochemical cell which is an electrolytic Schottky barrier that includes in sequence a transparent cover 25, a electrode 21 (thin metal film), a polymer electrolyte 23, a semiconductor 22 and another electrode 26 (see FIGURE 4). And, Han teaches away from the claimed multilayer solid-state device because the disclosed device has sandwiched between two semiconductor layers 3 and 7 an electrically conductive layer 5 that is made from a liquid electrolyte, solid electrolyte or non-metal like polyvinylcarbazole, tetranitrofluorenone and polypyrrole. In fact, the electrically conductive layer 5 of Han shown in FIGURE 1 is wavy or bumpy and does not look anything like an ultra-thin metal film as claimed in the present invention. The Examiner contended in the Office Action that Skotheim's highly conductive layer 134 and Han's electrically conductive layer 5 inherently provides for the ballistic transport of charge carriers however Applicant submits that this contention is not supportable in view of the present amendment because Skotheim's device and Han's device both require the presence of an electrolyte or non-metal like polyvinylcarbazole, tetranitrofluorenone and polypyrrole to properly function. Lindmayer and Green do not cure this defect.

Secondly, the claimed multilayer solid-state device includes a limitation where an ultra-thin metal (conducting layer) and a charge separation layer define a Schottky barrier. Neither Skotheim nor Han disclose an ultra-thin metal (conducting layer) and a charge separation layer that define a Schottky barrier. Instead, Skotheim discloses an electrolytic Schottky barrier device in FIGURE 4 that includes in sequence a transparent cover 25, an electrode 21 (thin metal film), a polymer electrolyte 23, a semiconductor 22 and another electrode 26. As can be seen, Skotheim's electrolytic Schottky barrier device has an electrode 21 (thin metal film) that is adjacent to a polymer electrolyte 23 which is not the same as the claimed multilayer solid-state device which has a Schottky barrier that does not involve the use of an electrolyte. Han, Lindmayer and Green do not cure this defect. In fact, Han, Lindmayer and Green do not even mention the term Schottky barrier.

Therefore, Applicant respectfully submits that the aforementioned substantial differences between the present invention and Skotheim, Han, Lindmayer and/or Green are indicative of the novelty and non-obviousness of pending independent Claims 4, 6, 9-12, 20, 24, 26-30, 32, 38-41, 43-46, 48-49, 57-58 and 60-64. Accordingly, Applicant respectfully requests reconsideration and allowance of pending independent Claims 4, 6, 9-12, 20, 24, 26-30, 32, 38-41, 43-46, 48-49, 57-58 and 60-64.

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Conclusion

From the foregoing, Applicant respectfully submits that all of the stated grounds of objections and rejections have been properly traversed, accommodated, or rendered moot. Accordingly, Applicant respectfully requests reconsideration of all outstanding objections and rejections and allowance of pending Claims 4, 6, 9-12, 20, 24, 26-30, 32, 38-41, 43-46, 48-49, 57-58, 60-67 and 69-96.

If the Examiner believes, for any reasons, that personal communication will expedite prosecution of this application the Examiner is invited to telephone the undersigned at the number provided.

It is believed that a fee is not required for this paper. If this is incorrect, the Commissioner is authorized to charge any fees which may be required for this paper to Deposit Account No. 50-0856.

Respectfully submitted,


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